BMI
GS-2 Power Line Monitor

User's Booklet

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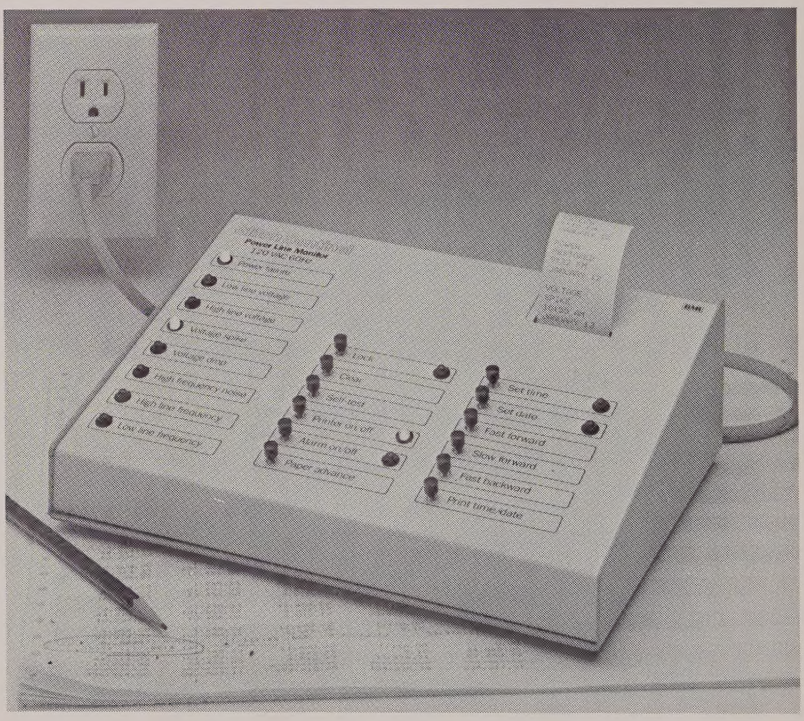
Table of Contents

Description . . . . . page 1
Using the monitor . . . . . page 2
Locking and unlocking . . . . . page 4
Changing the printer paper . . . . . page 5
Self-test . . . . . page 6
Technical manual . . . . . page 7
What the messages mean . . . . . page 8
How the measurements are made . . . . . page 13
Causes and solutions . . . . . page 16
If your monitor seems to misbehave . . . . . page 18
Specifications . . . . . page 19

Description



BMI Model GS-2

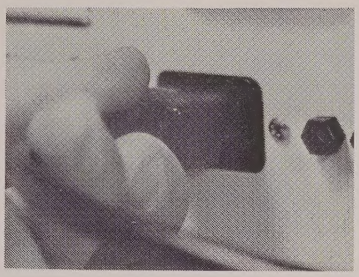
The BMI model GS-2 monitors power lines for problems that can disturb or damage sensitive electronic equipment. You simply plug it into the power line that you want to monitor.

It is equipped with indicator lights that show the power disturbances that have occurred, a thermal printer, an alarm beeper, an internal clock and calendar, and an internal set of rechargeable batteries that operate the clock and calendar during power failures.

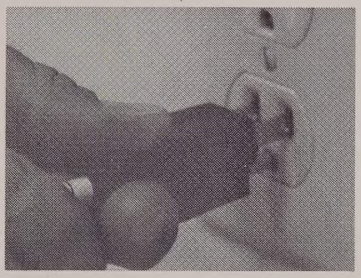
Using the monitor

GETTING STARTED

Unpack the monitor, and plug the power cord into the socket on the back of the monitor. When new, the connector may be stiff; push it in firmly, and be sure it is completely seated.



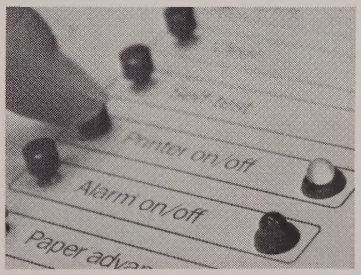
Plug the monitor into the power line that you want to monitor. The outlet must be grounded. If the monitor has not been plugged in during the previous fourteen days, it may print a message indicating that it is charging its batteries; otherwise, it immediately begins monitoring the power line.



The monitor does not have a power switch; it is turned on whenever it is plugged in. You should leave it plugged in, even when you aren't using it, to keep the batteries charged. The base of the monitor should be warm to the touch whenever it is plugged in.

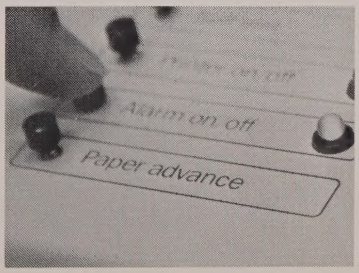
PRINTER ON/OFF

You can turn the printer on and off by pressing the **Printer on/off** button. If the **Printer on/off** light is on, the printer is on, and it will print whenever a power disturbance occurs.

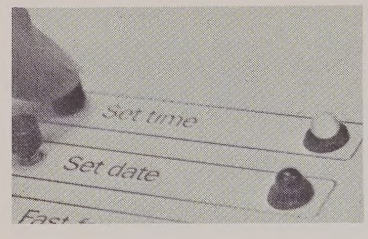


ALARM ON/OFF

You can turn the alarm beeper on and off by pressing the **Alarm on/off** button. If the **Alarm on/off** light is on, the alarm beeper will sound whenever one of the alarm lights is on.

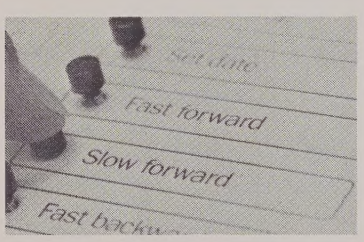


Using the monitor (continued)

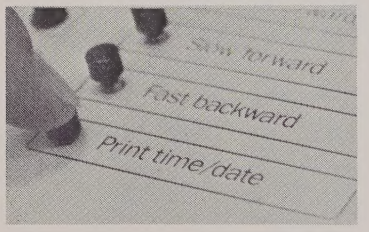


SETTING THE TIME

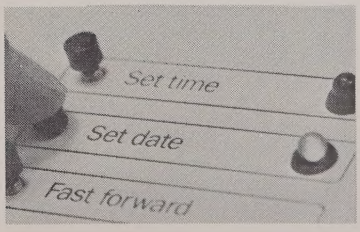
You should press the **Print time/date** button first to find out the current setting of the clock. Then press the Set time button. The Set time light will come on.



Adjust the clock with the **Fast forward** button, the **Slow forward** button, and the **Fast backward** button. Each time the beeper "bips", the clock has moved one minute forward or back.



You can check the new setting of the clock by pressing the **Print time/date** button again. Adjust the clock again as necessary.



SETTING THE DATE

Just press the **Set date** button, then follow the instructions for setting the time. Each time the beeper "bips", the date has been moved forward or backward one day. On the monitor's calendar, February always has 29 days.

If the batteries have been discharged, the clock/calendar is automatically set the midnight on January 1.

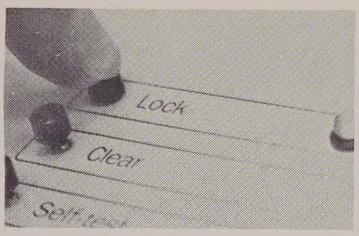
You should leave your monitor plugged in, even when you aren't using it, to keep the batteries charged. The batteries will operate the clock/calendar for 14 days without external power.

Locking and unlocking

LOCKING THE MONITOR

You can lock the monitor's keyboard to prevent casual tampering with the conrols by pressing the **Lock** button.

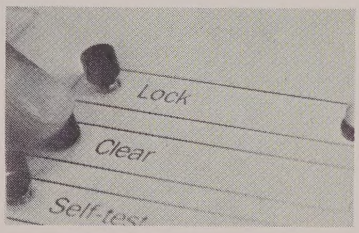
When the **Lock** light is on, the monitor is locked. Pressing any button will make the **Lock** light flash, and the beeper will beep four times. Pushing the button will not have any effect.



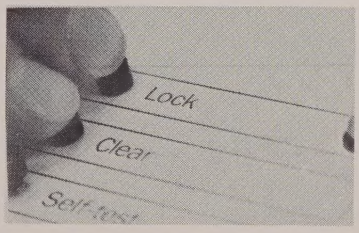
UNLOCKING THE MONITOR

You can unlock the monitor by pressing the following sequence of buttons:

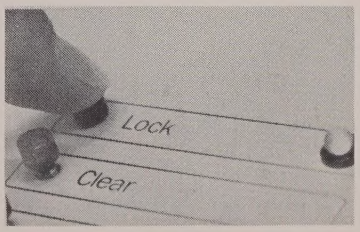
First, press and hold the **Clear** button.



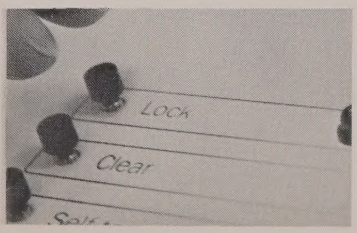
Second, press and hold the **Lock** button. Keep the **Clear** button pressed.



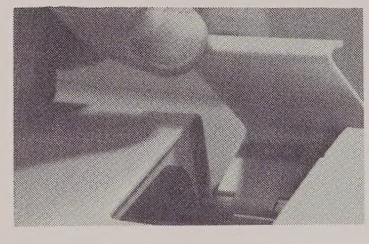
Third, release the **Clear** button. Keep the **Lock** button pressed.



Finally, release the **Lock** button. The **Lock** light will go out, and the monitor keyboard will be unlocked. The buttons will function normally.

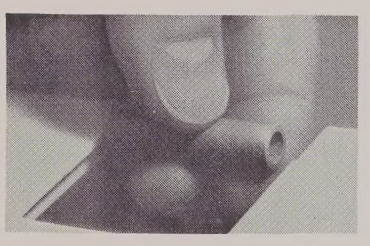


Changing the printer paper

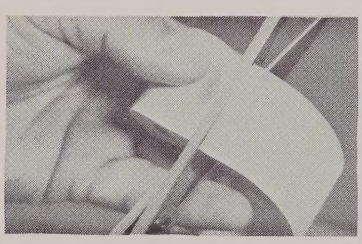


CHANGING THE PRINTER PAPER

You should change the printer paper when a red stripe appears along the edge of the paper. Press the **Paper advance** button to remove the remaining paper, and open the printer door.

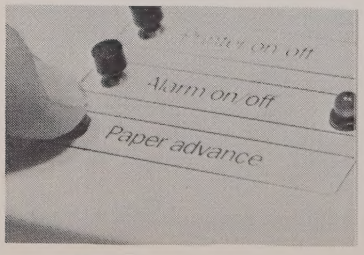


Remove and discard the cardboard roller from the printer.



Make sure that the edge of the new roll of paper is straight and smooth. You can use printer paper available from the factory, or you can use thermal paper for Casio calculators.

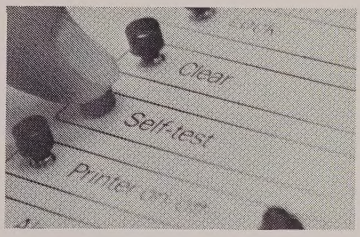
Feed the edge of the paper into the slot at the front of the paper holder. When you have fed it in correctly, you will be able to see the edge of the paper in the small rectangular opening immediately below the small rubber roller.



Press the Paper advance button until the paper comes out the front of the printer. If the paper is not being pulled off the roll, go back and make sure that you fed it into the printer correctly.

Self test

SELF-TEST OPERATION



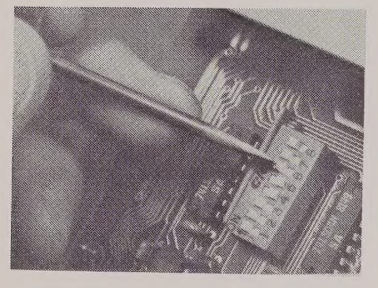
You can test the monitor by pressing the **Self-test** button. The self-test function requires a clean power line; you can check to see if you have a clean power line by pressing the Clear button. If all of the alarm lights go out, the power line is clean.

The self-test sequence turns on each light individually, then turns on all the lights, then tests the beeper, then checks the analog circuits. A message that clearly indicates whether the unit passed or failed will be printed at the end of the self-test sequence.

The self-test sequence checks the LED's, the processor, the EPROM's, the RAM, the memory interface and decode circuits, the input/output circuits, the beeper, the printer, the analog comparator circuits, the alarm timing circuits, and the alarm latches.

If self-test fails, you must press the **Clear** button to begin normal operation.

Technical manual

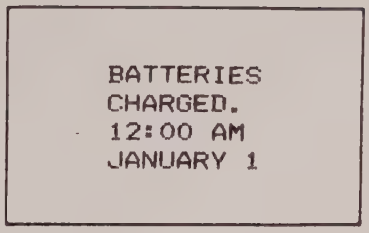


TECHNICAL MANUAL

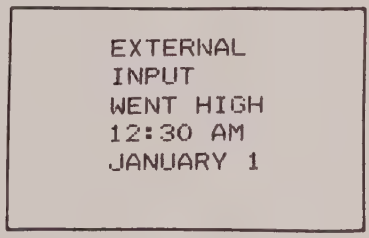
A Technical Manual is available that describes the internal option switch settings, the calibration adjustments, the alarm relay, the external TTL input, and other technical and optional features of the monitor. Contact the factory.

What the messages mean

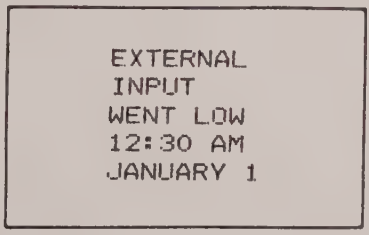
The internal rechargeable batteries are fully recharged. The monitor has been fully initialized, so the clock and calendar are set to midnight on January 1. You should leave the monitor plugged in to keep the batteries fully charged.



The external input option line on the monitor went to a high TTL level. (Option only)

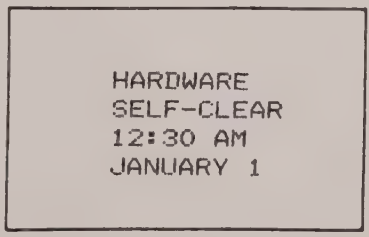


The external input option line on the monitor went to a low TTL level. (Option only)

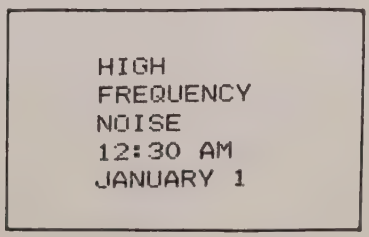


An internal monitoring circuit decided that the microprocessor had stopped running correctly for more than 10 seconds, and restarted the processor, or the Clear button was held down for several seconds.

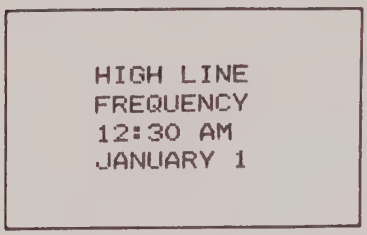
A hardware self-clear will disable the monitor if the batteries need charging, and it may not print a message to this effect. Leave the monitor plugged in to charge the batteries.



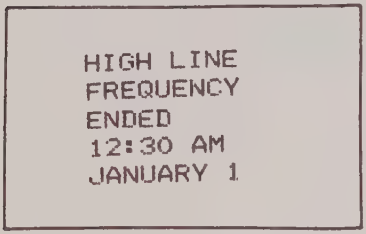
The monitor sensed high frequency noise on the power line.



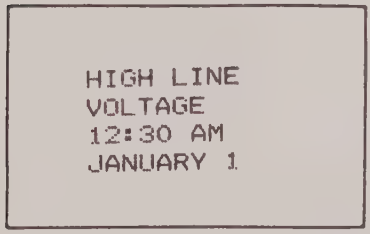
What the messages mean (continued)



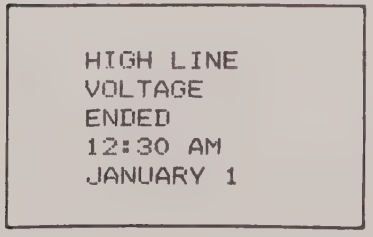
The monitor sensed that the line frequency was too high.



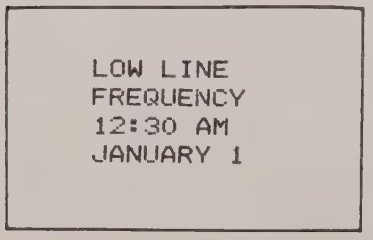
The monitor sensed that the line frequency had returned to normal.



The monitor sensed that the line voltage was too high.



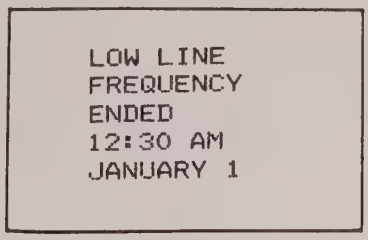
The monitor sensed that the line voltage had returned to normal.



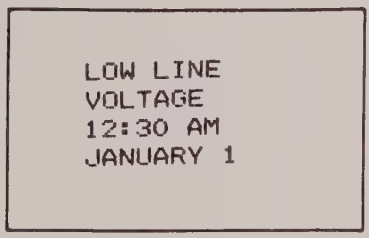
The monitor sensed that the line frequency was too low.

What the messages mean (continued)

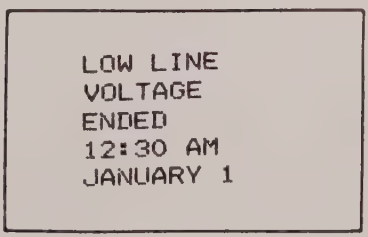
The monitor sensed that the line frequency had returned to normal.



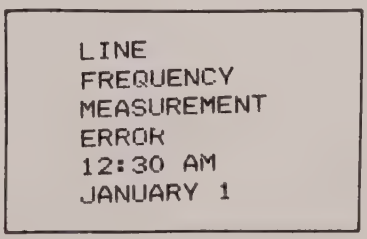
The monitor sensed that the line voltage was too low.



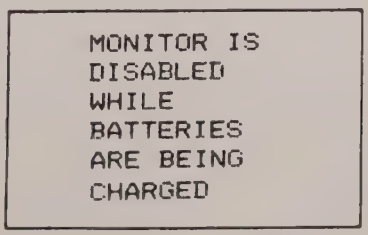
The monitor sensed that the line voltage had returned to normal.



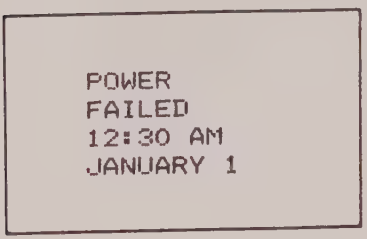
The monitor determined that the line frequency, as measured, was substantially incorrect (see how the measurements are made, page 11).



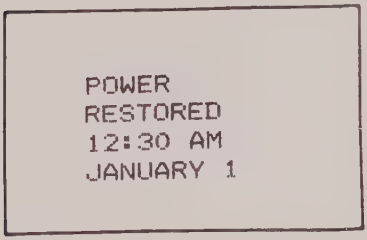
The monitor has disabled itself while the internal batteries are being charged. You should leave the monitor plugged in.



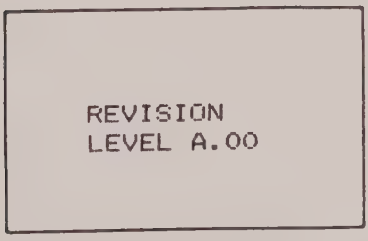
What the messages mean (continued)



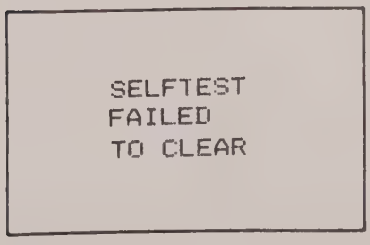
The monitor sensed that power had failed.



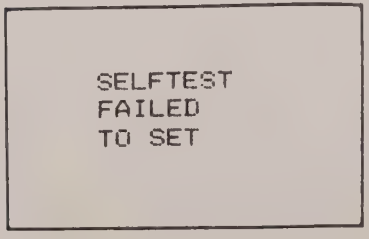
The monitor sensed that power was restored.



This is the revision level of your monitor. You pressed both the **Print time/date** button and the **Paper advance** button.



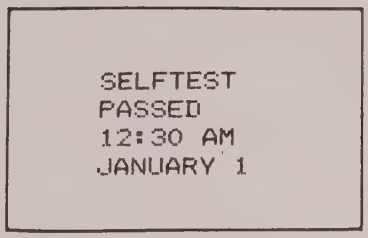
The monitor could not turn off one of the alarms while testing the unit. The problem alarm is identified in the message that immediately follows this message. The power line is probably incorrect; you need a clean power line to accurately perform the self test function (see page 6).



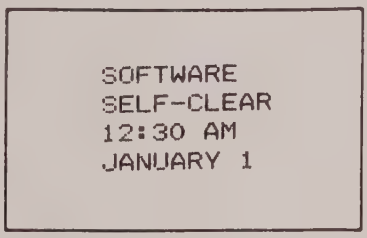
The monitor could not turn on one of the alarms. There is probably a defective or loose cable in the monitor.

What the messages mean (continued)

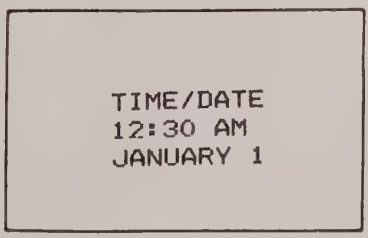
The monitor is completely functional.



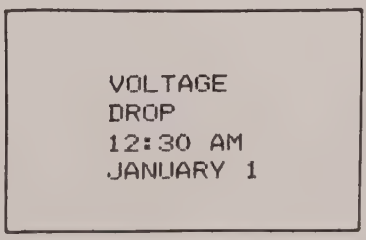
The monitor's software detected a software error. This message is always followed, a few seconds later, by a hardware self-clear.



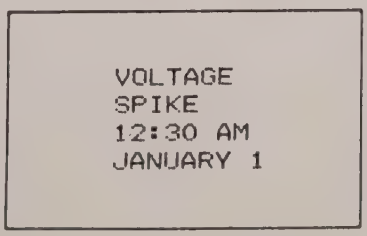
You pressed the **Print time/date** button.



The monitor detected a voltage drop on the power line.



The monitor detected a voltage spike on the power line.



How the measurements are made

VOLTAGES

In order to approximate the behavior of a linear power supply, all voltage measurements are peak sense equivalents of the RMS voltage specification (unless indicated otherwise below). Consequently, a distorted sin wave on the power line may cause a high line voltage indication or a low line voltage indication, even if an RMS reading of the power line indicates that it is within tolerance. This approximates the behavior of a linear power supply.

POWER FAIL

The power failure measurement is made from the hot line to the neutral line. The power failure indication occurs when the peak sense equivalent drops below the power failure threshold continuously for longer than the power failure minimum duration.

POWER RESTORED

The power restored measurement is made from the hot line to the neutral line. The indication occurs when the peak sense equivalent rises above the power restored threshold.

HIGH LINE VOLTAGE

The high line voltage measurement is made from the hot line to the neutral line. The indication occurs when the peak sense equivalent rises above the high line threshold continuously for longer than the high line voltage minimum duration.

LOW LINE VOLTAGE

The low line voltage measurement is made from the hot line to the neutral line. The indication occurs when the peak sense equivalent drops below the low line voltage threshold continuously for longer than the low line voltage minimum duration.

VOLTAGE SPIKE

The voltage spike measurement is made from the hot line to the ground line. The indication occurs when the voltage from the hot line to the neutral line exceeds the voltage spike threshold continuously for longer than the voltage spike minimum duration. The measurement is made through a high pass filter.

VOLTAGE DROP

The voltage drop measurement is identical to the power failure measurement, except for the minimum duration, which is set by the voltage drop minimum duration specification.

HIGH FREQUENCY NOISE

The high frequency noise measurement is made from the hot line to the ground line. The indication occurs when the peak-to-peak noise exceeds the high frequency noise threshold continuously for longer than the high frequency noise minimum duration. The measurement is made through a high pass filter. The specifications are accurate at 100 KHz; the monitor responds to noise from 25 KHz to 2 MHz with some loss in sensitivity at the upper and lower ends.

LINE FREQUENCY

The line frequency measurements are made from the hot line to the neutral line. The line frequency is determined by timing two successive zero-crossings of the sin wave. The line frequency is sampled at times determined by the processor (approximately 20 times per second, except when printing). The high line frequency indication and the low line frequency indication occur when four successive samplings of the zero crossing time indicate high or low line frequency. The line frequency measurement error indication occurs only if 255 successive samplings of the zero crossing time show substantial deviation from the nominal line frequency (this is typically caused by plugging the monitor into a power line of the wrong frequency, but it can also be caused by sustained high frequency noise of very high amplitude).

GENERAL NOTES

With the exception of line frequency, all of the alarms are monitored continuously; the line frequency is periodically sampled. The voltage alarms and the line frequency alarms generate printed messages both when they begin and when they end. The voltage spike alarm, the voltage drop alarm, and the high frequency noise alarm generate printed messages on their rising edges.

Causes and solutions

POWER FAILURE

Possible causes:
Monitor was unplugged. Circuit breaker tripped. Power distribution failure. Utility failure.

Possible solutions:
Separate circuit breaker. Circuit breaker with high rating and possible rewiring. Label on circuit breaker ("Do not turn off"). Battery backup for semiconductor memory with auto-start hardware and appropriate recovery software. Uninterruptible power supply (UPS).

LOW LINE VOLTAGE

Possible causes:
Overloaded power circuit. Starting of a large, heavily loaded motor. Utility power failure. Intentional utility "brown-out".

Possible solutions:
Separate circuit breaker. Voltage regulating transformer. Ferroresonant transformer.

HIGH LINE VOLTAGE

Possible causes:
Mistake in power wiring. Utility error. Internal power generation from heavy equipment.

Possible solutions:
Correct power wiring. Voltage regulating transformer. Ferroresonant transformer.

VOLTAGE SPIKE

Possible causes:
Switching inductive load. Static. Lightning.

Possible solutions:
High isolation transformer. Spike suppressor.

VOLTAGE DROP

Possible causes:
Starting of large motor. Switching of power mains (internal or utility). Addition of heavy load to distribution network. Utility error.

Possible solutions:
Ferroresonant transformer.

HIGH FREQUENCY NOISE

Possible causes:
Electric motors. Amateur or commercial radio broadcast. Arcing contacts, or other sparks.

Possible solutions:
Line filters. Separate power line. High isolation transformer.

LINE FREQUENCY ERRORS

Possible causes:
Incorrect setting of motor-generator. Power failure. Switching power factor correction capacitors.

Possible solutions:
Correct setting. Improved speed regulation.

If your monitor seems to misbehave...

IF IT WON'T DO ANYTHING:

Is it plugged in? Is the line cord connector firmly seated in the back of the unit? Is there power on the outlet?

IF NONE OF THE BUTTONS WORK:

Is it locked (see the lock light, and the description on page 4)? If not, try the full initialization procedure below.

IF IT INDICATES A POWER PROBLEM THAT ISN'T THERE:

Read how the measurement is being made (page 13), and make sure there really is a problem.

IF SELF-TEST FAILS:

Read the Self-test instructions on page 6. If the failure message starts with SELFTEST FAILED TO CLEAR, the problem is probably an unclean power line. If it starts with SELFTEST FAILED TO SET, the problem is probably a broken cable inside the unit.

IF THE PRINTER WON'T PRINT:

Is the printer turned on (see page 2)? Is there paper in the printer?

HOW TO FULLY INITIALIZE YOUR MONITOR

1. Unplug the monitor.
2. Hold the paper advance button down.
3. With the paper advance button down, plug the monitor into a clean outlet.
4. The BATTERIES CHARGING message will be printed. The monitor is fully initialized. You may need to wait for the BATTERIES CHARGED message; leave the monitor plugged in.

HOW TO CHECK THE REVISION LEVEL OF YOUR MONITOR

1. Unlock the keyboard, if the monitor is locked (see page 4).
2. Press and hold both the paper advance button and the print time/date button. The time and date will be printed twice, followed by the revision level message. The revision level will be a letter, followed by two digits. The higher the letter, the later the revision.

Application	120 VAC 60 Hz	120 VAC 50 Hz	120 VAC 400 Hz	120 VAC 415 Hz	240 VAC 60 Hz	240 VAC 50 Hz	208 VAC 60 Hz	220 VAC 50 Hz	Tolerance
Model number	GS-2	GS-2A	GS-2B	GS-2C	GS-2D	GS-2E	GS-2F	GS-2G	
Power failure									
Threshold	80 Vrms	80 Vrms	80 Vrms	80 Vrms	160 Vrms	160 Vrms	160 Vrms	147 Vrms	10%
Minimum duration	500 mS	500 mS	500 mS	500 mS	500 mS	500 mS	500 mS	500 mS	20%
High line voltage									
Threshold	125 Vrms	125 Vrms	125 Vrms	125 Vrms	250 Vrms	267 Vrms	217 Vrms	231 Vrms	3%
Minimum duration	100 mS	100 mS	100 mS	100 mS	100 mS	100 mS	100 mS	100 mS	10%
Low line voltage									
Threshold	105 Vrms	105 Vrms	105 Vrms	105 Vrms	210 Vrms	211 Vrms	182 Vrms	198 Vrms	3%
Minimum duration	100 mS	100 mS	100 mS	100 mS	100 mS	100 mS	100 mS	100 mS	10%
Voltage spike									
Threshold	200 Vpeak	200 Vpeak	200 Vpeak	200 Vpeak	200 Vpeak	200 Vpeak	200 Vpeak	200 Vpeak	10%
Minimum duration	10 μS	10 μS	10 μS	10 μS	10 μS	10 μS	10 μS	10 μS	10%
Voltage drop									
Threshold	80 Vrms	80 Vrms	80 Vrms	80 Vrms	160 Vrms	160 Vrms	160 Vrms	147 Vrms	10%
Minimum Duration	20 mS	20 mS	20 mS	20 mS	20 mS	20 mS	20 mS	20 mS	10%
High frequency noise									
Threshold	2 Vpk-to-pk	2 Vpk-to-pk	2 Vpk-to-pk	2 Vpk-to-pk	2 Vpk-to-pk	2 Vpk-to-pk	2 Vpk-to-pk	2 Vpk-to-pk	10%
Minimum duration	50 mS	50 mS	50 mS	50 mS	50 mS	50 mS	50 mS	50 mS	10%
Specified frequency	100 KHz	100 KHz	100 KHz	100 KHz	100 KHz	100 KHz	100 KHz	100 KHz	
Usable response	25 KHz-2MHz	25 KHz-2MHz	25 KHz-2MHz	25 KHz-2MHz	25 KHz-2MHz	25 KHz-2MHz	25 KHz-2MHz	25 KHz-2MHz	
High line frequency									
Threshold	61 Hz	51 Hz	408 Hz	423 Hz	61 Hz	51 Hz	61 Hz	51 Hz	1%
Minimum duration	500 mS	500 mS	500 mS	500 mS	500 mS	500 mS	500 mS	500 mS	
Low line frequency									
Threshold	59 Hz	49 Hz	392 Hz	407 Hz	59 Hz	49 Hz	59 Hz	49 Hz	1%
Minimum duration	500 mS	500 mS	500 mS	500 mS	500 mS	500 mS	500 mS	500 mS	

GS-2S SPECIAL ORDER

Customized Specifications

Application _____ VAC

_____ Hz

Model number _____

Power failure

Threshold _____

Minimum duration _____

High line voltage

Threshold _____

Minimum duration _____

Low line voltage

Threshold _____

Minimum duration _____

Voltage spike

Threshold _____

Minimum duration _____

Voltage drop

Threshold _____

Minimum duration _____

High frequency noise

Threshold _____

Minimum duration _____

Specified frequency _____

Usable response _____

High line frequency

Threshold _____

Minimum duration _____

Low line frequency

Threshold _____

Minimum duration _____

SERIAL # _____

BMI

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